

Who are we doing Global Software Engineering research for?

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Abstract— Twelve years ago a group of practitioners and researchers came together to try to solve problems relating specifically to Global Software Engineering (GSE) practice. This paper aims to assess whether the many hundreds of GSE research papers written over this period have had an impact on practice. We conducted semi-structured interviews with senior managers and project managers from ten companies, four of which are large multinationals (three in Fortune 100); four are medium sized enterprises, and two are small startups. GSE research is perceived as useful by industry with all participants stating that studying the subject would improve GSE performance; but all were unanimous in saying they did not read articles on GSE. Practitioners go to books, blogs, colleagues, forums, experience reports of 1-2 pages in length, or depend on their own experience to solve problems in GSE. Controversially, many didn’t see GSE as separate from general project management. Practitioners don’t want frameworks; they want patterns of context specific help. While dissemination techniques need to be improved, that is not sufficient. Experience-based advice is just as important.

Keywords—*Global Software Development; Global Software Engineering; empirical research; theory and practice; research dissemination; practitioner experience.*

I. INTRODUCTION

Researchers have been studying Global Software Engineering (GSE) for well over a decade. This research has identified numerous problems resulting from developing software in a globally distributed manner, and many solutions to these problems have been identified [1-3]. But do practitioners benefit from these results? This study attempts to answer this question.

We interviewed employees of ten companies as part of a feasibility study conducted to assess the commercial potential of a decision support system [4, 5] conceived to give advice about GSE processes and practices. As part of the study, we asked the participants about what problems they encountered as a consequence of engaging in GSE, and where they go for advice and solutions to address those problems.

The problems cited by the participants are well known to the GSE research community. However, none of the participants in the study look to the research literature on GSE for advice or solutions, despite unanimously agreeing that such research has the potential to improve the

performance of GSE projects. Rather, they tend to consult books, blogs, trade press, and their peers. Further, to our surprise, many of the participants did not think of GSE as something separate from their day to day project management activities.

This led us to reflect that perhaps we were asking the wrong question. This paper takes a step back, and asks – who are we doing our research for? Clearly there are pockets of supporters as, for example, the IEEE International Conference on Software Engineering (ICGSE) attracts both practitioners and researchers. However it seems that there is a large group of influential and successful organizations that GSE research is not reaching. Top level managers, engaged in GSE in companies ranging from startups to large multinationals, are aware of GSE problems, perceive that research could help them become more productive, but do not read research papers documenting the results of such studies.

GSE has established itself as a separate field of research, as exemplified by ICGSE (now in its seventh year), and its many spin-off workshops such as GlobAgile, Knowing, REMIDI, PARIS and VirtuES. In addition, there have been several special issues in journals, dedicated to reporting GSE related research. Also top tier journals report on global software development matters. For example, IEEE Software, which states that it is “the authority on translating software theory into practice” [6] has published numerous articles on GSE outside of its special issues on Global Software Development in 2001 and 2006.

The published research includes topics on GSE tools, GSE process, requirements, and risks; in fact there are a reported twenty-four systematic literature reviews that bring together groups of papers across a range of GSE topics [7]. Many of the studies are empirical, where observations are drawn directly from practice. The reason GSE is studied and reported is that there are distinct problems and distinct solutions, lessons learnt and best practices that the community would like to share.

This paper is organized as follows; Section II provides a brief background to the state of GSE research, how it all began, its aims and how it has evolved over time, also there is a reflection on research and practice, this is followed by

our methodology in Section III (data collection, sampling, data analysis, demographics). We then present our results in Section IV— where responses to our semi-structured interview questions are reported; Section V discusses the implications of our results for GSE followed by Section VI that considers some threats to validity. Section VII concludes the paper with a summary of our findings and recommendations.

II. BACKGROUND

Global Software Engineering (GSE) is now an established research area with a growing body of potentially useful results. This section briefly examines the history of this research in order to motivate our Research Questions, which are introduced at the end of this section.

A: GSE Research - History and Results

GSE has been a recognized research area since at least 1999, when the first workshop on "Software Engineering over the Internet" was held at the International Conference on Software Engineering (ICSE) in Los Angeles [8]. This workshop series, expanded in 2002 to the more general topic of "Global Software Development" [9], eventually evolved into the International Conference on Global Software Engineering (ICGSE), which was first held in Brazil in 2006 [10].

TABLE I. IEEE PUBLICATIONS ON GSE 1999-FEB 2013¹

<i>Content Type</i>	<i>Freq</i>
Conference and workshop proceedings	1,126
Journals and magazines	114
Books and eBooks	6
Total	1,246

Table I shows a summary of papers on GSE related topics found in the IEEEExplore digital library, that were published between 1999 and the beginning of 2013. The vast majority of these are published in conference and workshop proceedings. Papers presented at these conferences and workshops have addressed a wide range of topics. Interestingly, what was initially considered to be a "software engineering" problem is now recognized as much more than that. Topics likely to impact the success of GSE include: software processes and methodologies; software engineering project management; and social and human resources.

More than a decade of research on GSE has revealed a handful of problems that are repeatedly encountered by organizations attempting GSE [2, 11] (see Table II). Further, in addition to revealing common recurring problems,

researchers have identified or developed solutions to these problems. For example, researchers have created and evaluated tools such as DOCTOR to support distributed reviews [12], or CAMEL "to improve the richness of the communication among geographically distributed software engineers" [13] as infrastructure solutions. Existing processes and methods, especially Agile methods, have been adapted to GSE [14-18]. Also, new process models such as the Global Teaming Model [1] and the Integrative Framework for Managing Risks in Distributed Software Projects [19] have been developed.

Most importantly, however, these solutions have been validated with empirical evidence [2]; not only have problems been identified, but solutions that are known to work have been presented. We would have expected that this growing body of research literature would be a rich source of information for practitioners on how to solve GSE related problems and avoid GSE pitfalls.

TABLE II. COMMON PROBLEMS RELATED TO GSE

<i>Problem Area</i>	<i>Example problem</i>
Geographic, Temporal, and Cultural distance	Lack of informal communication
Organization	Increased communication overhead
Management	Need for timely reporting; tailoring rewards; attrition
Process	Scaling co-located to distributed environment
Infrastructure	Tool mismatch among teams
Fear and Trust	Impeded communication

B: Research and Practice

The notion of recognizing practitioner needs was clearly articulated by Pfleeger, who notes, "It is not enough to develop new theories and provide evidence. The practitioners, who are the audience for our evidence, must be able to understand our theories and findings in the context of their work and values" [20].

In his 1996 inaugural "Practical Programmer" column in Communications of the ACM [21], Robert Glass went further in arguing that there was a "theory and practice divide". According to Glass, researchers simply do not have the required experience to make their theories the solution of choice. This column went on to suggest that researchers were conjuring up the software crisis, when in fact practice was doing "just fine".

At the time of writing the column, Glass did not believe there was a convincing body of research in certain areas (e.g. maintenance); that some research solutions were not necessarily scalable such as programming in the large; also that researchers do not have the exposure to the real, complex domains to allow them to verify the feasibility of their theories, e.g. in modelling and simulation. Glass voiced a potential reason for practitioners being sceptical

¹ Search string = (((("Document Title": "global software development") OR "Document Title": "global software engineering") OR "Document Title": "distributed software") OR "Document Title": "outsourcing")

about taking the advice of theorists: "Theorists who fail to evaluate their ideas in a practical setting before advocating them are of particular concern" [21].

More than 15 years of research has been undertaken in the interim, and as Glass noted at the time, his comments were intentionally controversial to provoke further discussion on this subject. Yet his point is still valid today; despite the fact that it would be rare to find a solution or tool published in a top-tier conference or journal that had not gone through some form of validation, can we really expect practitioners to take a leap of faith and apply a theory that hasn't been proven in practice first?

A recent case study conducted by Microsoft Research and West Virginia University asked the question "How should the research community talk to industrial practitioners?" [22]. Kocaguneli et al's study [22] relates closely to our own since their answers are drawn from a comparison between collocated and distributed development. They came up with three rules that researchers should follow in their communications with industry: "relevance, recheck and reflect". Of particular interest is the reflection that "the effect size of the differences seen between collocated and distributed software was so small that it need not concern industrial practitioners". Yet, prior to this reflection, a 'recheck' of old results found significant difference between the quality of Microsoft products built by distributed or collocated teams. Without the reflection this finding might have led them to question the practice of distributed development.

C: Practitioners and Current GSE Research

Industry-based researchers, and practitioners, have participated in GSE workshops and conferences from the outset. Additionally, international research programs were encouraged by industry. For example, GSE was the initial research strand funded by Science Foundation Ireland in 2004 during the establishment of Lero – the Irish Software Research Centre. This grant was strongly supported by multi-national industry in Ireland and the national Industrial Development Authority. Siemens Corporate Research, who had initiated the Global Studio Project were instrumental in working with the ICSE Workshop Committee to ensure that ICGSE became a full conference in 2006.

At ICGSE 2010 a separate "industry track" was introduced that aimed to increase the focus on industry; the ICGSE 2012 industry track comprised nearly a quarter of the publications in the main conference (nine papers out of 37). Yet, the dissemination of the published research results beyond the academic community is unclear. Concerned about this issue, we propose three research questions designed to assess whether we, as GSE researchers, are addressing the right problems, and whether our results are reaching the right people. These questions are as follows:

RQ1: What problems do practitioners perceive they have with their GSE projects?

Rationale: We know that practitioners experience problems with GSE. The literature is rich in providing this evidence. This question is not intended to find new problems, rather to give this study some context, and check that our group of practitioners are likely to need some form of GSE support.

RQ2: How do practitioners perceive the usefulness of studying GSE research, if at all?

Rationale: We want to investigate if there is a perception that studying GSE could be of benefit to practitioners.

RQ3: Where do practitioners go to for help with their GSE-related issues?

Rationale: We want to know if practitioners are actively looking for help, and if so where. Also, by contrasting this answer with the previous question, we get an indication of whether academic articles are meeting the needs of the practitioner.

III. METHODOLOGY

The data analysed in this study was originally collected for a different study intended to test the commercial potential of a decision support system for GSE [4, 5]. This feasibility study was funded by Enterprise Ireland and was conducted during October-December 2012 by independent researchers who subsequently joined the list of authors in this study. We consider how this method impacts on our study in more detail in our Limitations section (Section VI).

The next section describes the data collection method used for the general feasibility study, and then we describe how we analysed this data specifically for this study.

A. Research Method and Data Collection

Since the role and importance of GSE research to industry² is still a largely unexplored research area, a qualitative research approach is appropriate [23]. With this in mind, our general methodology was to take an open inductive approach to our data collection and analysis [24]. We used open ended questions with the aim that they will generate rich and detailed descriptions of the phenomenon under investigation – which in our case is to explore how GSE research is perceived by industry. However, for the one question relating to identifying GSE problems, we applied a deductive approach, where our previous research informed our codes, and validated our results [2].

To collect data from practitioners we conducted an in-depth exploratory, qualitative survey using semi-structured interviews. The use of interviews gives us the flexibility to go deeper into unforeseen types of information that may emerge during an interview [25].

We adopted purposive sampling for company selection. Purposive sampling involves selecting companies most representative of the population being studied [26]. In this case, companies engaged in GSE who met pre-determined

² Although industry continues to participate in ICGSE, the activities of the vast majority of organisations engaged in GSE remain hidden.

criteria were selected. These criteria were – company size (start-up, SME, multinational) and organisational structure (onshore headquarters, offshore headquarters).

We identified ten companies and invited them to participate in the study. Table III lists background information on the participating companies. Four of the companies are large multinationals (three in Fortune 100 and one a professional services consultancy); four are medium sized organizations, and two are start-ups.

TABLE III. ORGANISATIONS IN OUR STUDY

Organization	Type	Head-Quarters	Number of participants
Google	MN	California	1
Incaplex	Start-up	Ireland	1
KPMG	MN	Netherlands	1
Microsoft	MN	Washington	1
NewBay	SME	Dublin	1
Openet	SME	Ireland	2
Oracle	MN	California	2
Realex Payments	SME	Ireland	1
Small Irish Start-up	Start-up	Ireland	1
Terminal 4	SME	Ireland	1

From these selected ten companies, senior managers and project managers volunteered to participate. Table IV lists these participants, their role, years of GSE experience, number of GSE projects and the number of different GSE setups in which they have been involved. All the participants had significant GSE experience with an average of over 13 years. This experience was divided over multiple GSE projects ranging from ten to one hundred where a variety of different project setups were applied. At the time of the interview, all the participants were based in Ireland. We do not link participants to companies for confidentiality reasons; hence the two tables III and IV are sorted differently.

In total, we drew data from 12 participants who worked at ten different organizations. Participants P3 and P4 came from the same company and were interviewed together, as were P9 and P10. The participants worked at organizations across a range of domains and all had experience with managing GSE projects. For six of the participants, Ireland was the company headquarters, while for four of the participants Ireland was a regional office. P1 typically worked on small scale projects with one virtual developer and budgets in the range of €50 to €1,000. The largest GSE project for P3 and P4 was across three sites with a group of 65 developers. P6 spent 7 months working in a project involving “the head office plus 5 more sites”. This involved more than 20 engineers. P7 would typically work on 18 month projects involving a US based head office and regional sites in Bangalore, Romania and Dublin. P9 and

P10 typical GSE setup involved a US based head office and two regional offices, Dublin and East Asia. P11 has worked in GSE projects involving 30 developers.

TABLE IV. PARTICIPANTS IN OUR STUDY

ID	Role	GSE Experience in years	GSE Projects	GSD setups
P1	CEO	6	30	30
P2	COO	20	Dozens	5
P3	VP Technology	13	Greater than 100	12
P4	Director of Engineering	13	Greater than 100	12
P5	Technical Project Manager	24	15 to 20	Unknown
P6	Head of Product Development	8	Over 10	8
P7	Development Manager	12	50	4
P8	Engineering Manager	15	Many tens of projects.	5
P9	Development Lead	16	10+	4
P10	Test Lead	16	10+	4
P11	Director, Management Consultant	16	15	4
P12	CEO	1.5	1	1

Prior to conducting the interviews, we designed an interview protocol as recommended by Taylor and Bogdan [27]. The protocol listed all the interview questions and grouped them according to our areas of interest to include: GSE difficulties, GSE Learning, Use of Consultancy to solve GSE problems, as well as demographic information (as listed in Tables III and IV). The questions asked can be accessed at <http://ore11.ul.ie/files/Lero-TR-2013-01.pdf>.

All but one interview was conducted at the premises of the participants’ organisations. No recording equipment was used as it can make participants uncomfortable [27], particularly, when questioning competency [28]. In fact participants might be unwilling to discuss certain topics, might hold back information or might not be completely honest.

Two researchers conducted the interviews. Each researcher had a different role; one led the interview, while the other asked additional questions when it was appropriate. Both researchers took notes on responses. Our rationale for having two researchers was that a previous study [28] indicated that participants talked more with two interviewers than with one, more follow-up questions were asked and it allowed for comparison of interview notes and verification of their interpretation post interview. This last point is particularly significant given the decision not to use recording equipment. Out of the ten interviews conducted, eight interviews lasted approximately one hour; the

interviews which had two participants lasted one hour and thirty minutes.

B. Data Analysis

Due to the qualitative nature of the collected data, we chose to analyze the data using thematic analysis. Thematic analysis identifies concepts in narrative text, then synthesizes these concepts into major categories or "themes" that summarize the meaning of the text from a particular point of view [29]. In our case, the point of view is determined by our research questions. We took the following steps:

1. We identified which interview questions from our data collection addressed each of our research questions.
2. We sorted interview notes into answers to each of the interview questions, and further subdivided these answers into groups according to participant's company.
3. Two authors examined each response and assigned a short phrase or code to identify the concept or concepts conveyed. Concepts and codes were created "on the fly" in a manner similar to open coding [23]. Both researchers discussed and agreed on a code before assigning.
4. When all answers for a given interview question were coded, we examined the entire set of codes for a given interview question, and coalesced codes identifying similar concepts into broader themes.
5. In the case of identifying GSE problems, our previous research informed our codes, and validated our results [2]. For answers regarding the value of GSE research, since all were positive, we agreed on three levels of strength ('definitely', 'probably', and 'maybe'). For sources of information, we started with categories "academic publications" and "consultancy", and then added categories for the remaining concepts.
6. Having thus identified major themes we mapped each fine grained code to the theme to which they belong.
7. Finally, we counted the number of interviews where each theme was mentioned, and sorted the result in order of frequency. These frequencies are presented in Tables V-VII in the following section.

We associated the themes with each interview, and counted the number of times a given theme was discussed across different interviews. We do not record how many times a theme is discussed within the same interview.

IV. RESULTS

This section summarizes the answers given to six interview questions resulting from ten separate interviews of representatives of ten different companies. The results are

grouped broadly according to our three research questions, as follows:

A. *Problems participants perceive to be the result of engaging in GSE.* These answer RQ1 "What problems do practitioners perceive they have with their GSE projects?"

B. *Opinions about the value of studying GSE.* These opinions answer RQ2: "How do practitioners perceive the usefulness of studying GSE research, if at all?"

C. *Where participants go for solutions to problems related to GSE (4 interview questions addressed this point).* This sub-section answers RQ3: "Where do practitioners go to for help with their GSE-related issues?"

The following sub-sections examine each of these results categories in detail.

A. Problems related to GSE

All participants reported encountering problems related to GSE. Table V lists the main categories of problems, in order of the number of interviews in which the problem was mentioned. Many of the barriers listed in Table V cause problems with communication. For example, geographic, cultural, and temporal distances make communication difficult. We have, where possible, shown the barrier rather than the effect. However, when the participant just said that communication is a problem we have listed this as "communication overhead".

In five interviews, "cultural distance" was raised as an issue; cultural distance was seen mainly as a communication barrier, with language acting as a major factor. Also, mismatch in expectations due to cultural differences was mentioned: one participant observed that different cultures have different views on quality; another described a situation where employees relocating temporarily from Asia to Ireland expected to be given a "warm coat allowance", and were annoyed when the allowance wasn't given.

Four interviews mentioned the lack of face-to-face communication that results from geographic distance: "The biggest issue is missing those hallway conversations; formal conversations are different in nature." "Distance causes difficulties." Temporal distance was mentioned in four interviews.

Increased overhead due to the need for more frequent communication with remote sites was cited as a communication issue in four interviews. One participant observed, "There are problems with any multi-site project with 'hand offs' and need for increased communication."

Curiously, trust was mentioned in only one interview, and then indirectly when the participant observed that client-vendor contracts were often too short to develop strong relationships with the vendor. As a whole, the problems raised by participants are well known to the GSE research community, e.g., [2, 30, 31], and in many cases multiple solutions have been identified [1, 32, 33].

TABLE V. WHAT PROBLEMS DO PRACTITIONERS PERCEIVE THEY HAVE WITH GSE?

<i>Barrier to GSE</i>	<i>Freq</i>	<i>Examples</i>
Cultural distance	5	Work ethic; language; religion.
Communication overhead	4	Increased need to communicate (more often with more people).
Temporal distance	4	Lack of time zone overlap.
Infrastructure	4	Tool mismatch, logistics.
Organization	4	Vendor selection; sourcing skills, task allocation.
Geographic distance	4	People get left out of conversations
Lack of Process	3	Testing and QA; rolling out best practices.
Management	2	Coordination.
Cost	1	Vendor retention cost; true cost of outsourcing.
Fear and trust	1	Vendor relationship building.

GSE was acknowledged as a problem even for experienced managers. Although the problems get easier to tackle with experience – especially when they are tackled early instead of being allowed to fester and increase - ignoring the problems is not a solution since they do not disappear by any means. They are inherently difficult.

None of the companies measured the cost of GSE difficulties (albeit two of the interviewees had some limited experience with this). In the course of the interviews one practitioner clearly identified that he did not view GSE in isolation, observing, “You get problems (“us and them” type problems) even between two floors in the same building.” This reflected a general sense that their task was engineering management and they needed to view GSE problems as part of this.

B. The Value of Studying GSE

To assess practitioner views on GSE research, we asked each group of participants, "Do you think that studying the subject would improve GSE performance in real projects?"

TABLE VI. PERCEIVED VALUE OF GSE RESEARCH

<i>Question</i>	<i>Definitely</i>	<i>Probably</i>	<i>Maybe</i>
"Do you think that studying the subject would improve GSE performance in real projects?"	7	2	1

As shown in Table VI, in eight of ten interviews, the response was positive, ranging from "absolutely" and "definitely yes" to "yes" to "probably." One additional participant responded "yes" but qualified his answer by stating he would be more likely to take advice from people with "skin in the game" (which we take to mean that he

would take advice from other software engineering managers, but not from those “just” studying the field). The final participant answered "perhaps" without elaborating.

Taken as a whole, these responses indicate practitioners have a positive view of the idea of GSE research. One participant noted that it is particularly important to be able to read into GSE when new to the area and its challenges.

C. Sources for Solutions

We asked four questions regarding where practitioners find information about GSE solutions. Participants were asked to elaborate on any positive answers.

1. *Have you read academic articles on GSE?*
2. *Have you read other useful articles on GSE?*
3. *Have you searched for GSE-related advice on the web?*
4. *Have you wished-for/ searched-for/ bought GSE consultancy?*

Table VII shows the main sources of information used by participants, along with the number of interviews in which the source was mentioned. Of particular interest is that only *one* participant acknowledged that he had recently read academic papers on GSE. Further, this participant qualified this with an opinion that the articles he read appeared to be promoting a book on the topic. One participant recalled reading an article in the past, and one other said he read one while at university. The remaining participants do not look to the research literature for advice.

TABLE VII. WHERE DO PRACTITIONERS GO TO FOR GSE HELP?

<i>Source</i>	<i>Freq</i>	<i>Example</i>
Books	7	Agile, GSE, outsourcing, project management, technical
Other Practitioners (inter-active networks)	7	LinkedIn; blogs; communities of practice; discussion forums; peers
Web (to access info)	4	Agile community web; general web
Non-GSD articles	3	project management
Vendor material	1	white papers
Intranet	1	internal knowledge base
Consultancy	1	in agile or lean methods
Academic publications on GSE	1	book promotion article; when at university

Books on GSE or GSE-related topics (Project Management, Agile Methods, Outsourcing) were the most common source of information. Using other practitioners as a source of information was equally popular. Practitioner advice was obtained directly through peer contact or communities of practice, or indirectly through online forums or blogs.

Web sites were next in popularity, including sites devoted to Agile Methods. These resources of choice were followed by articles on non-GSE areas such as general Project Management, or vendor white papers. Another

participant described an internal resource on their corporate intranet as his main source of advice.

D. Results summary

The results of this study are analysed according to whether we as GSE researchers, are addressing the right problems with solutions that are reaching the right people. The participants acknowledged that they had problems with GSE related issues and there was a general consensus in thinking that studying GSE has some value. However, the consensus was heavily against reading academic, peer-reviewed articles. Instead they preferred to use either text books or interactive social networks where they can discuss issues with other practitioners.

A side effect of asking GSE related questions was the finding that many managers did not view GSE as a distinct set of practices – they tended to view GSE as integral to their project management process. Within this larger process, they may look for advice on, for example, how to deal with different cultures. This search for advice tended to be *ex post facto* when a given situation revealed an obvious gap in knowledge.

V. DISCUSSION

This study reveals three facts:

1. Problems mentioned by participants are well known and well-studied by the GSE research community. Themes such as global distance [34], communication [35], fear and trust [36], cost [30, 37-39], and process [1, 40] were mentioned in our interviews and have come up time and again in the GSE context [3, 11].

2. Many solutions have been identified to address each of these problems, solutions that are based on empirical evidence. Many of these are in the form of guidelines, process models and frameworks, e.g. [1, 37, 41-44].

3. Practitioners perceive that GSE research is potentially valuable.

Despite these facts, *none* of the practitioners in our sample regularly looked to the GSE literature for solutions; most *never* consult the GSE literature. What are the reasons for this paradox?

First is **accessibility**. Practitioners do not have time to read and digest academic publications, in order to extract potentially relevant solutions to their specific problems. Also, practitioners must interpret these research results in the context of their own organization.

Second is **credibility**. Glass's [21] assertion of the research-practice gap is nicely reflected in the preference for advice from people with "skin in the game". Experience is a key factor to where practitioners go to for help with their GSE issues, as noted by this participant: "we talk to other managers who run teams elsewhere in the world ... that is where we get our advice". When they can't speak to peers

directly, they use resources such as blogs, wikis and their corporate intranets, where information comes from other practitioners.

Last is **relevance**. Academic publications are written to satisfy academic standards of scientific rigor, and follow conventions appropriate for academic discourse. As such, much of the content of a typical academic publication is not relevant to a manager seeking an introduction to global GSE issues, or solutions to his or her specific problems. This finding is supported by Kocaguneli et al [22], whose first rule for researchers to talk to practitioners is to report 'relevant' results. Practitioners are looking for syntheses of GSE knowledge. As one participant noted, "It [GSE] is mostly common sense, but initial reading can help new managers to learn some lessons from others. In general methodologies are less important than common sense."

It seems these are the reasons that *books* were mentioned as often as *other practitioners* as a source of information about GSE: books synthesize either research results, experience, or both; as such, they are a relatively concise source of "learning in an area" as the book's authors have already done the background research and interpretation.

Practitioners are also looking for patterns and anti-patterns, as noted by this manager: "I did use a book and in that book there were process patterns that I could recognize". Further, solution-oriented papers that propose methods or process models are viewed as too general. As one GSE manager notes, "everything needs to be applied in a company specific way". This view was echoed by another manager who said, "I think it is useful to study the learning in an area as opposed to definitive advice or a fixed methodology which will go out of date very quickly."

Perhaps another reason that practitioners do not place a high value on GSE specific guidelines and methodologies is because they view GSE practices as integral to project management; as noted in the results, you can experience the same problems due to distance between floors as you can as a result of distance between countries.

On the subject of relevance, there was also the indication that practitioners do not view GSE in isolation; GSE would not be something practitioners would necessarily recognise as a discrete set of issues and solutions. Aspects such as coping with a 'them and us' culture, or process issues, were all viewed as general project management issues.

In summary, it is clear from our results that GSE research is addressing the right problems; but in order to have real impact, the solutions resulting from that research need to be communicated in a way that is **accessible**, **credible**, and **relevant** to practitioners.

VI. LIMITATIONS

Construct validity. Construct validity in this study concerns whether the questions we ask actually capture the participants' feelings about GSE research. There is some

threat to construct validity in that our interview questions were designed to investigate the commercial potential of a decision support system for GSE. For example there are several questions that were asked in the interview that we do not report here. However, all questions relating to ‘How do practitioners perceive GSE research?’ are included in this paper. If we were to conduct a study to answer the overriding question of “For whom are we doing GSE research?” we would use the exact subset of interview questions reported here.

Internal validity: Internal validity in this study is concerned with whether we accurately recorded the responses, - i.e. do the notes written up by the researchers truly reflect the responses, and then do we synthesise and interpret those notes correctly? As we relied on interviewers’ notes, we may have missed some items. However as there were always two researchers conducting each interview, taking detailed notes, the likelihood is reduced. Also when we report our findings, we do not list how many times a given theme was reported in each interview, as these numbers may be unreliable. We do not consider this finer detail to be important to this study, since we want to know how many *different* participants mention a given theme. We are confident that we have captured this information.

External validity: The sample size is relatively small, when compared to the size of the population of all GSE organisations. Also, many of the GSE organisations have their central office in Ireland, which introduces some bias in the sample. For this reason we must be cautious about generalizing our results, as our sample may not be representative of the population of all practitioners involved in GSE. However, our sample was not opportunistic but purposive – we have a broad if small sample and therefore have a level of confidence that it is likely that other practitioners involved in GSE would exhibit similar behaviour.

VII. CONCLUSION

In this paper we presented an empirical study of how a sample of high level managers in multinational organisations, SMEs and start-up companies view research into Global Software Engineering (GSE). Our original aim was to identify whether companies would make use of a Decision Support System for Global Teaming practices we were developing. To our surprise, many of these managers did not recognize GSE as something separate from their day-to-day project management activities. This led us to reflect that perhaps we were asking the wrong question. This paper takes a step back, and asks: for whom are we doing our research?

Clearly there are pockets of software industry supporters as ICGSE attracts both practitioners and researchers. However, it seems that there is a group of influential and successful organizations that GSE research is not reaching. Top level managers, working in globally distributed

companies such as Google, KPMG, Microsoft and Oracle, are aware of GSE-related problems, perceive that research could help them become more productive, but do not read papers documenting the results of that research when looking for solutions.

By questioning these managers in ten organizations, we uncovered that practitioners tend to go to their peers or to project management text books for advice. They also find social networks useful. They do not want to read lengthy papers which have been written using academic vocabulary. They do not find that complete frameworks are of interest, tending to prefer clusters or *patterns* of information that are easier to contextualise and implement.

In our future work, therefore, we need to consider the dissemination of our results. Our study would indicate that researchers need to get out from their offices and meet practitioners half way; hoping and wishing that our work will reach its intended audience is insufficient. We need to be pragmatic and change the way we publish. We need to summarise our work on blogs, hold industry-focused forums, listen closely to what practitioners are discussing, and become part of a GSE community of *practice*.

Perhaps a more important point to address is that practitioners are unlikely to look at academic articles, regardless of *where* they are published, if they are written by non-practicing researchers. As researchers, we need to work a lot more closely with industry, and include practitioners as *authors* as well as subjects. This will ensure that results are relevant to *practice*.

In summary, we need to continue to do sound empirical research, and build evidence-based solutions. But in addition, we need to craft solutions that are relevant and accessible, and we need to disseminate those solutions in ways that are meaningful to *practitioners*, not just other researchers.

Findings from this study point to the following recommendations:

*The Why: Ensure research is **relevant** and reflects the needs of practice – and can confidently answer the question of why the research is being conducted.*

*The What: Write shorter papers that are **evidence-based**, using **accessible** non-academic language, where findings are **validated** to ensure they are **credible**. These studies need to include a detailed **context** (as companions to the theoretical, detailed and academic work).*

*The Who: Researchers and practitioners should work more closely together – **collaborate** in both conducting and reporting the research.*

*The Where: Researchers need to **disseminate** their work more **widely**, venture into the ‘grey’ literature – also use social networks, blogs and wikis.*

Finally, to answer the question posed in the title of this paper “who are we doing GSE research for?” It appears that the research relating to globally distributed software engineering is being performed largely for us. And by ‘us’, we mean, those researchers who are working with practitioners to solve industry related GSE problems, or those practitioners who straddle the practice-research divide and participate in writing and presenting their work at our conferences. But researchers conducting research for ‘us’ isn’t necessarily bad in the short term. Producing good research can identify gaps, as well as spur other researchers on to find new and better ways to build software in distributed settings. However, eventually, the research conducted in support of industry needs to reach its intended audience.

In the words of one of our practitioner participants, creating a community of practice for GSE might be the way to solve the problem of the practice- research divide.

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